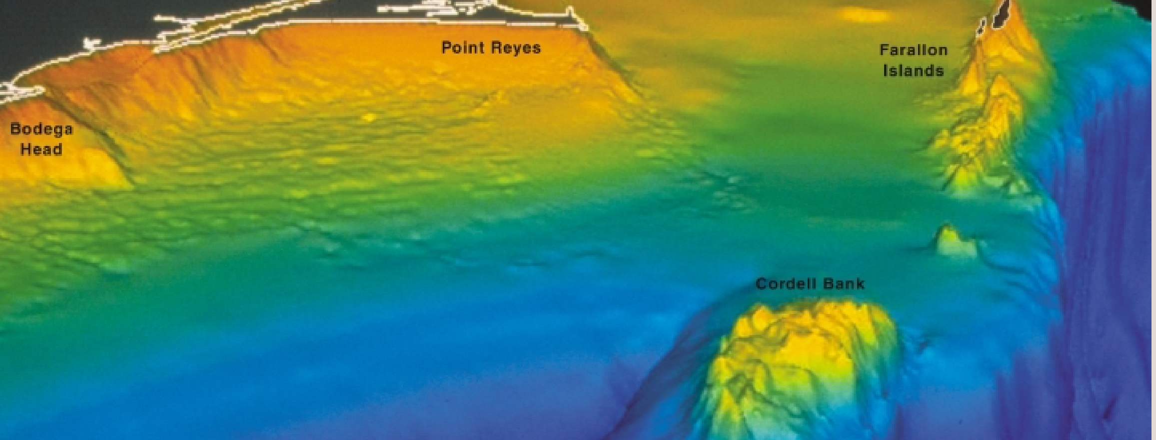
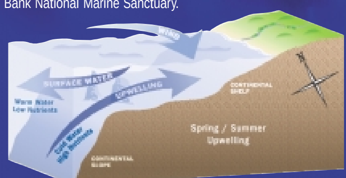


Upwelling is the Key

During springtime, strong northwest winds push the water southward along the California coast. Gale winds and ocean currents combined with the force of the Earth's rotation drive surface water away from the shore. These waters are replaced by upwelling of deeper and colder nutrient rich waters from offshore. When this nutrient rich water enters the sunlit surface waters near the coast, the nutrients become available for surface dwelling phytoplankton or marine algae. Phytoplankton are the foundation of the food web and the infusion of nutrients, and increased sunlight in spring initiates a bloom of life that radiates up the food web. An abundance of phytoplankton, zooplankton, and young fish are food for the animals at higher levels of the marine food web. This bounty of food attracts huge numbers of seabirds, fish, whales, and other marine mammals to the waters of Cordell Bank National Marine Sanctuary.



Island on the Move

Cordell Bank was originally created approximately 93 million years ago as part of the southern Sierra Nevada mountains. Over time as the Pacific Plate moved north it sheared off the part of the North American Plate that included Cordell Bank. As the Pacific Plate moved north it carried Cordell Bank to its present location west of Point Reyes, and continues to move north, at a rate of about 3.5 inches (9 cm) per year. Cordell Bank emerges from the soft sediments of the continental shelf deposited more recently by coastal erosion. Between 20,000 and 15,000 years ago when sea level was about 360 ft (110 m) below what it is now, it is believed that most of Cordell Bank was exposed making it a true island. Within 7 miles (11 km) of the Bank's western edge the seafloor drops to over a mile deep.

Key to colors of image- This 3-D image is the seafloor extending west of Point Reyes to the edge of the continental shelf. The vertical relief of the continental slope is exaggerated due to the spatial scale of the image. The close proximity of a shallow rocky habitat to the deep open ocean ecosystem contributes to the spectacular biological diversity at Cordell Bank.

sea level
40 meters
80
120
160
200
240

Cordell Bank Activities

Whale watching trips are one way to get a glimpse of life at Cordell Bank. NOAA

Commercial whale and seabird watching trips are conducted in the Sanctuary to view ocean wildlife. Blue and humpback whales migrate from Mexico each year to feed from June through November. Gray whales pass through the Sanctuary on their 10,000-mile (16,000 km) migration, between Mexico and Alaska during the months of December and January, and March through April.

Birders from around the world come to Cordell Bank to see seabirds rarely seen so close to shore. Due to more predictable sea conditions, most trips occur in summer and fall.

Pink-footed Shearwater *(Puffinus carneipes)* is the second most frequent shearwater in the Northeast Pacific and above Cordell Bank. Rich Stallcup

Sanctuary Regulations

- Discharging certain materials from any location within the boundary of the Sanctuary is prohibited.
- Discharging from any location beyond the boundaries of the Sanctuary any materials which enter the Sanctuary and injure a Sanctuary resource is prohibited.
- Exploring and extracting hydrocarbons are prohibited
- Removing, taking, or injuring benthic (bottom dwelling) organisms is prohibited.
- Removing, taking, or injuring cultural or historical resources is prohibited.

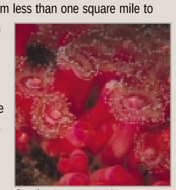
Permits for scientific and educational use may be issued by the Sanctuary for regulated activities.

Recreational scuba diving is not recommended at this site, due to depth and currents.

This summary is for reference only and does not include all exemptions or other activities regulated within the Sanctuary under local, state, or federal authorities. For more information about Sanctuary regulations, please consult the full published text at 15 CFR Part 922, subpart-K or contact the Sanctuary office P: (415) 663-0314 W: www.cordellbank.noaa.gov

What is a National Marine Sanctuary?

Our national marine sanctuaries embrace part of our collective riches as a nation. Within their protected waters, giant humpback whales breed and calve their young, coral colonies flourish, and shipwrecks tell stories of our maritime history. Sanctuary habitats include beautiful rocky reefs, lush kelp forests, whale migrations corridors, spectacular deep-sea canyons, and underwater archaeological sites. Our nation's sanctuaries can provide a safe habitat for species close to extinction or protect historically significant shipwrecks. Ranging in size from less than one square mile to over 5,300 square miles, each sanctuary is a unique place needing special protections. Natural classrooms, cherished recreational spots, and valuable commercial industries—marine sanctuaries represent many things to many people.



Strawberry anemones *(Corynactis californica)* Cordell Expeditions

Western Gulls *(Larus occidentalis)* NOAA

Cordell Bank National Marine Sanctuary
1 Bear Valley Rd., Point Reyes, California 94956

phone: (415) 663-0314 fax: (415) 663-0315
e-mail: cordellbank@noaa.gov
web: www.cordellbank.noaa.gov

NATIONAL MARINE SANCTUARIES™

A National Marine Sanctuary

Cordell Bank

Rosy rockfish, *(Sebastes rosaceus)* Don Dvorak, Cordell Expeditions

Cordell Bank National Marine Sanctuary, California

Cordell Bank is an underwater island 4.5 miles (7 km) wide by 9.5 miles (15 km) located approximately 50 miles (80 km) north-west of San Francisco and 20 miles (32 km) west of the Point Reyes Lighthouse. The Cordell Bank National Marine Sanctuary protects the Bank and the 526 square miles (1347 square km) of surrounding waters.

This submerged island sits on a peninsula surrounded by deep water on three sides. Its granite peaks rise from the soft bottom of the continental shelf to within 120 ft (37 m) of the water's surface. A unique combination of undersea topography and oceanic conditions creates an extremely productive marine environment, supporting a wide diversity of plants and animals. This distinctive environment was officially recognized when it was designated as a national marine sanctuary in 1989.

Leather Star *(Dermasterias imbricata)* Lovell and Libby Langstroth

The National Marine Sanctuary System

The National Marine Sanctuary Program serves as the trustee for a system of thirteen underwater parks, encompassing over 18,000 square miles of marine and Great Lakes waters from Washington State to the Florida Keys, and from Lake Huron to American Samoa. The National Oceanic and Atmospheric Administration's (NOAA) has managed national marine sanctuaries since passage of the Marine Protection, Research, and Sanctuaries Act in 1972. Protecting sanctuary resources requires a great deal of planning, management, and cooperation between federal, state, and local officials. The National Marine Sanctuary Program works cooperatively with its partners and the public to promote conservation while allowing compatible commercial and recreational activities. Increasing public awareness of our marine heritage, scientific research, monitoring, exploration, educational programs, and outreach are just a few of the ways the National Marine Sanctuary Program fulfills its mission to the American people. The program's staff is ever mindful of their responsibility to protect America's ocean treasures for this and future generations.

Scale varies in this perspective.
Adopted from National Geographic Maps.

An Abundance of Life

Two worlds come together at Cordell Bank. A rocky reef community, where substrate is crucial, intermingles with an open ocean realm, where life exists in three dimensions. The offshore location of Cordell Bank is in one of the most productive ocean areas in the world. Sedentary organisms adapted to living on the bottom are washed with a constant supply of food-rich water. Animals adapted to an open ocean lifestyle travel thousands of miles each year to feed in the waters around Cordell Bank. The result is an abundance of marine life with a unique composition of species.

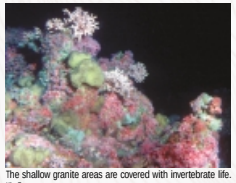
Hydrocoral *(Stylaster californicus)* use stinging cells to capture prey. Kip Evans

The california sea cucumber *(Parastichopus californicus)* feeds on dead organic matter. Kip Evans

Life on Cordell Bank

Many of the bottom dwelling organisms that live on Cordell Bank started life riding the currents of the Pacific Ocean as free floating larvae. The upper reef areas are proof of successful settlement on the Bank. The granite towers and reef areas between 115 ft (35 m) and 165 ft (50 m) are a brilliant cascade of colors. Space is limiting at these depths as sponges, ascidians, anemones, hydrocorals, and sea stars carpet the bottom one on top of the other. The same currents that delivered these organisms to the Bank also provide them with a constant supply of food.

The fish-eating anemone *(Urticina piscivora)* feeds on fish and invertebrates. Kip Evans



The shallow granite areas are covered with invertebrate life. Kip Evans

The decorator crab *(Laxorhynchus crispatus)* is a master of camoflauge, using sponges, anemones, and algae to blend in with the habitat. Cordell Expeditions

Seabirds

Sanctuary waters teem with life that is food for thousands of seabirds nesting on the Farallon Islands and Point Reyes peninsula, and as far away as the Hawaiian Islands. Migrant and seasonal pelagic birds from as far as Australia and New Zealand also stopover at Cordell Bank to feed. The Bank is known as the albatross capital of the Northern Hemisphere. Five of the fourteen species of albatross worldwide have been seen at Cordell Bank and its surrounding waters.

Illustration from the National Audubon Society: The Sibley Guide to Birds, by David Allen Sibley, published by Alfred A. Knopf, Inc. Copyright © 2000 BY Chanticleer Press. All rights reserved. Reproduced with permission of the copyright holder.

Black-footed Albatross are the most common albatross seen in the Sanctuary. Recent studies have documented food gathering trips between their nest sites on the northwest Hawaiian Islands and Cordell Bank.

The Black-footed Albatross *(Phoebastria nigripes)* has a seven-foot wingspan. Rich Stallcup

Sooty Shearwaters *(Puffinus griseus)* blanket Cordell waters in late summer to early fall. Rich Stallcup

The Northern Fulmar *(Fulmarus glacialis)* may be seen in winter months offshore of California. Rich Stallcup

Fish

"Cordell Bank is a Sanctuary. It's brimful of life. The fish are never cranky. The place is very swanky." Jimmy Gilardi, West Marin School

Diverse habitats support an abundance of fishes. Flatfish such as sanddabs and sole live on the mud and sand bottom of the Sanctuary. Solitary bottomfish and schooling fish find refuge among the Bank's granite rocks and pinnacles. The food rich waters around Cordell Bank support over 150 species of fish. The most abundant are the rockfish ranging in size from the 8-inch (10 cm) pygmy rockfish to the 3-foot (91 cm) yellow-eye rockfish.

Lingcod *(Ophiodon elongaus)* feed on squid, fish, and octopus. Lovell and Libby Langstroth

Juvenile rockfish *(Sebastes spp.)* school around pinnacles. Cordell Expeditions

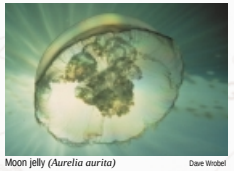
China rockfish are one of many species of rockfish at Cordell Bank. Kip Evans

Leatherback sea turtle *(Dermochelys coriacea)* Nancy Black

Open Ocean

After the spring and summer upwelling season ends, the surface currents around Cordell Bank relax. With this change, many gelatinous animals including salps, ctenophores, and jellies fill the water column. Leatherback sea turtles, ocean sunfish, and many of the mid-water rockfishes eat these creatures that are drifting during this relaxed sea state.

Ocean sunfish *(Mola mola)* Steve Lock



Moon jelly *(Aurelia aurita)* Dave Wrobel

Pacific white-sided dolphins *(Lagenorhynchus obliquidens)* travel in pods of 20 to over 1,000 animals. NOAA

Blue whales *(Balaenoptera musculus)* feed along the edge of the continental shelf during summer and fall. Dan Shapiro

Whale watchers are frequently rewarded with sightings of breaching humpback whales *(Megaptera novaeangliae)*. Tom Kleckhefer

Marine Mammals

Twenty-six species of marine mammals (whales, dolphins, seals, and sea lions) are known to frequent the waters of Cordell Bank. The Sanctuary is one of the most important feeding grounds for blue and humpback whales in the world. These whales travel from their breeding areas in Mexico to feed on the abundant krill and schooling fish that aggregate near the Bank. In late summer, breaching humpbacks are frequently seen around the Bank. Common and Pacific white-sided dolphin pods are attracted by plentiful food resources and can be seen in large numbers. Pinnipeds such as California sea lions, elephant seals, and Steller sea lions frequent Sanctuary waters to feed on krill, squid, and juvenile fishes.

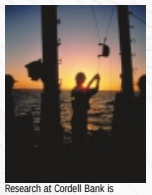
Krill are "shrimp-like" organisms measuring approximately one inch (2.5 cm) in length. Many predators including whales, seabirds, and fishes are attracted to the Cordell Bank area by the large concentrations of krill.

Krill *(Euphausia pacifica)* Steven Haddock

Past and Present

Cordell Bank was discovered in 1853 by George Davidson of the U.S. Coast Survey while returning from a mapping expedition on California's north coast. Edward Cordell conducted additional surveys in 1869 when he was sent to relocate a "shoal west of Point Reyes." Cordell was attracted to the location by the numerous birds and marine mammals in the area.

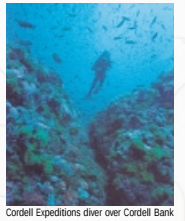
Cordell Bank was first explored underwater in 1977 by the non-profit research association, Cordell Expeditions. Intermittently over the course of 10 years, divers documented the organisms living above and on the Bank. Through these efforts, images of the biological diversity of Cordell Bank were available to the public for the first time. This effort was instrumental in creating Cordell Bank National Marine Sanctuary.



Research at Cordell Bank is conducted around the clock. NOAA

Today the Sanctuary participates in ongoing studies to examine the relationship between oceanographic conditions and the distribution and abundance of marine life. Research focuses on the link between krill and the presence of humpback, blue whales, and seabirds.

Vessel similar to the type that Cordell sailed Courtesy San Francisco Maritime National Historic Park



Cordell Expeditions diver over Cordell Bank Cordell Expeditions

Background image: bathymetric chart of the northern part of Gulf of the Farallones and Cordell Bank